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Section II. (REMARKS)

The pending claims in the application are 15-37.

Provisional Double Patenting Rejection Under the Judicially Created Doctrine of Obviousness-Type Double Patenting

In the October 24, 2006 Office Action, the Examiner provisionally rejected claims 15-17 and 20-23 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 49-64 of copending U.S. Patent Application No. 10/602,172.

When the obviousness-type double patenting rejection is the only rejection remaining to the presently pending case AND if the presently pending claims are an obvious variation of the invention defined in claims 49-64 of co-pending U.S. Patent Application No. 10/602,172 (which can only be objectively assessed when the only rejection remaining in the presently pending case is the obviousness-type double patenting rejection), applicants will consider submitting the required terminal disclaimer.

Rejection of Claims and Traversal Thereof

In the October 24, 2006 Office Action:

claim 36 was rejected under 35 U.S.C. §112, first paragraph;

claims 15-23, 25-27, 30, 35 and 37 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sehgal (U.S. Patent Application Publication No. 2004/0050406A1);

claims 24 and 28-30 were rejected under under 35 U.S.C. §103(a) as being unpatentable over Sehgal in view of De Young et al. (U.S. Patent No. 6,669,785); and

claims 31-34, were rejected under 35 U.S.C. §103(a) as being unpatentable over Sehgal (U.S. Patent Application Publication No. 2004/0050406A1) in view of Xu et al. (U.S. Patent Application Publication No. 2003/0125225).

These rejections are traversed and reconsideration of the patentability of the pending claims is requested in light of the following remarks.

Rejection under 35 U.S.C. §112, first paragraph

In the May 11, 2006 Office Action, claim 36 was rejected under 35 U.S.C. §112, first paragraph, for failing to comply with the written description requirement. Applicants traverse such rejection.

As previously introduced, to satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention at the time of filing. MPEP §2163 (I) (citing *Vas-Cath, Inc. v. Mahurkar*, 19 U.S.P.Q.2d 1111, 1116 (Fed. Cir. 1991)). Claim limitations may be supported in the specification through express, implicit or inherent disclosure. See, MPEP §2163.

Turning to the present case, applicants disclose that the composition is useful for removing ion implanted photoresist layers from a substrate having same thereon (see, e.g., instant specification, paragraph [0016] and [0030]). Accordingly, when applicants' composition comprising at least one SCF, at least one co-solvent, at least one etchant, and at least one surfactant is used according to the process of claim 36, wherein a substrate having an ion-implanted photoresist layer thereon is contacted with the composition, the composition will thereafter further include ion implanted photoresist material. If the composition includes ion implanted photoresist material, the composition will ***inherently*** include at least one implantation ion.

Further, as stated in MPEP §2163, the examiner has the initial burden of presenting evidence or reasoning to explain why persons skilled in the art would not recognize in the original disclosure a description of the invention defined by the claims. See *In re Wertheim*, 191 USPQ 90, 97 (CCPA 1976).

According to the Examiner:

> "the claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

> Specification sections of paragraphs [0016} [sic] and [0030] as applicants mention in the previous response do not provide support for the limitation of "the removal composition comprising at least **one implanted ion**". In the above sections, specification just discloses removal of ion implanted photoresist using the SCF based composition but nowhere in the specification discloses that the composition comprises at least one implanted ion." (See, October 24, 2006 Office Action, paragraph bridging pages 3-4) (emphasis in original)

In other words, the Examiner has stated that the specification fails to expressly disclose that the composition comprises at least one implanted ion. This is not the standard - a specification that implicitly or inherently discloses the claimed invention also satisfies the written description requirement. At this point, the Examiner's burden is to present evidence or reasoning to explain *why* one skilled in the art would **not** recognize in the original disclosure the inherent disclosure of the invention defined by the claims.

Accordingly, withdrawal of the rejection of claim 36 under §112, first paragraph, is respectfully requested.

Rejection under 35 U.S.C. §103(a)

1. In the October 24, 2006 Office Action, claims 15-23, 25-27, 30, 35 and 37 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sehgal (U.S. Patent Application Publication No. 2004/0050406A1) (hereinafter Sehgal). Applicants traverse such rejection.

According to the Examiner:

> "Sehgal teaches the temperature of the super critical fluid will be much higher than critical [sic] temperature of 31 degree C (paragraph 0010) and that could be 55 degree C as explained in example 1 (paragraph 0074).
>
> Sehgal also teaches the higher temperature (about 80 degree) and pressure will accelerate the stripping of photoresist using the supercritical fluid (paragraph 0058).
>
> Therefore, it would have been obvious to one of ordinary skilled [sic] in the art would have been motivated to do so for accelerating the stripping rate." (see October 24, 2006 Office

Action, page 5, lines 9-15)

Applicants vigorously disagree.

It is well established as a matter of law that prior art references must be considered as a whole. *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 220 U.S.P.Q. 303 (Fed. Cir. 1993), *cert. denied*, 469 U.S. 851 (1984).

The Examiner contends that Sehgal teaches that the temperature of the supercritical fluid "will be much higher" than the critical temperature of 31°C, however, paragraph [0010] of Sehgal merely states that "[c]arbon dioxide has a critical temperature of 31°C" and that "when CO_2 is subjected to temperature and pressure above these critical conditions, it is in the critical state." There is no express teaching in Sehgal that the temperature of the SCF "be much higher" than the critical temperature of 31°C, as contended by the Examiner.

The Examiner then contends that Sehgal teaches that the temperature of the supercritical fluid "could be 55 degree C as explained in example 1." Example 1 of Sehgal recites:

> "[0074] In a first example, a substrate having a hard baked I-line photoresist that was DUV stabilized using UV lamps to achieve 100% cross-linking was placed in the process chamber. **A co-solvent 1 composition of 40% (by weight) 1,2-Butylene Carbonate, 30% Dimethyl Sulfoxide, and 30% of 30% hydrogen peroxide was mixed at a temperature of 55°C**.
>
> [0075] The 1,2-Butylene Carbonate was selected for its high solvency and the fact that it makes a single-phase solution with hydrogen peroxide. Ethylene or Propylene Carbonate or blends of Ethylene and Propylene Carbonate may be substituted for the 1,2-Butylene Carbonate (and vice versa) in this and the following examples. The hydrogen peroxide was selected for its ability to attack the cross-linked bonds of the photoresist, and the dimethyl sulfoxide was selected for its ability to carry out photoresist stripping. This mixture was made to flow into the process chamber and onto the substrate at a rate of 8 g/min for approximately 90 seconds. Supercritical carbon dioxide was caused to flow into the chamber with the co-solvent 1 at a flow rate of 72 g/min to have a total fluid flow rate into the process chamber at 80 g/min. **The temperature and pressure within the chamber were 110°C and 165 bar, respectively**." (emphasis added)

Considering Example 1 as a whole, as the Examiner must do, it can be seen that the Sehgal composition that is maintained at 55°C does not include an SCF but rather is a "liquid concentrate" that is subsequently mixed with the SCF. The Sehgal composition that includes an SCF (and the "liquid concentrate") is actually maintained at 110°C. In contrast, applicants' claim 15 recites:

> **"A method of removing a bottom anti-reflection coating (BARC) layer from a substrate having same thereon, said method comprising contacting the substrate having the BARC layer thereon with an SCF-based removal composition comprising at least one SCF, at least one co-solvent, at least one etchant, and at least one surfactant, for sufficient time and under sufficient contacting conditions to at least partially remove the BARC layer from the substrate, wherein the contacting conditions comprise temperature in a range of from about 50°C to about 90°C."** (emphasis added)

In other words, applicants' SCF-based removal composition includes the SCF and the contacting conditions comprise temperature in a range from about 50°C to about 90°C. In contrast, Sehgal discloses a composition devoid of SCF that is maintained at 55°C or a composition including the SCF that is maintained at 110°C. Considered *in toto*, Sehgal does not teach that the temperature of the supercritical fluid "could be 55 degree C as explained in example 1."

The Examiner further contends that Sehgal also teaches that "the higher temperature (about 80 degree) and pressure will accelerate the stripping of photoresist using the supercritical fluid (paragraph 0058)." Paragraph [0058] of Sehgal recites:

> "$scCO_2$ process conditions accelerate photoresist stripping compared to processing done at ambient pressures. For example, as shown in the examples in this application, a 10,000' thick blanket I-line photoresist that was hard baked at 110°C for 90 s and at 160°C for 60 s can be completely dissolved under $scCO_2$ conditions of 2400 psi and 100°C in 4 minutes using a mixture of propylene carbonate, dimethyl sulfoxide and hydrogen peroxide. The same photoresist/solvent solution combination took 47 minutes to dissolve the same photoresist on a hot plate at ambient pressure/15 psi and 80°C. In this example the $scCO_2$ conditions accelerated the photoresist stripping rates by over an order of magnitude."

Again, considering Sehgal as a whole, Sehgal does not teach the use of a supercritical fluid at

80°C, but rather a photoresist/solvent solution at ambient pressure (15 psi) and 80°C. It is not possible to convert CO_2 to the supercritical state at a pressure of only 15 psi. It is noted that the only temperature recited in paragraph [0058] corresponding to the supercritical state is 100°C. Again, Sehgal does not teach the use of a "higher temperature (80 degree C)" supercritical fluid.

In short, the Examiner has contended that Sehgal teaches the use of a supercritical fluid composition at temperature in a range from about 50°C to about 90°C. It does not -Sehgal actually fails to motivate, teach or suggest the use of a supercritical fluid composition at temperature in a range from about 50°C to about 90°C.

Instead, Sehgal includes a schematic of the CO_2 phase diagram, as reproduced below for ease of reference. It can be seen that so long as the pressure is greater than 72.8 atm and the temperature is greater than 31°C, CO_2 is in the supercritical state. There is no guidance provided in Sehgal as to which temperature, between 31°C and the highest achievable temperature at 72.8 atm, the contacting should be carried out, other than 100-110°C (see the Examples in Sehgal). In other words, in view of the phase diagram, the only argument the Examiner has is that it would be obvious to try other temperatures above the critical temperature. Obvious to try is not the standard for establishing obviousness.

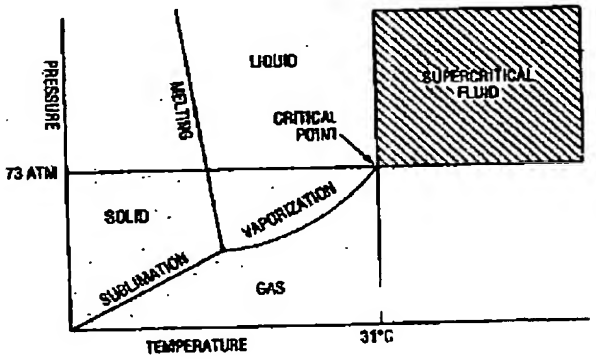

FIG. 1

In conclusion, the Examiner has not established a *prima facie* case of obviousness because Sehgal was not considered as a whole. Withdrawal of the rejection of claims 15-23, 25-27, 30, 35 and 37 as being rejected under 35 U.S.C. §103(a) over Sehgal is respectfully requested.

2. In the October 24, 2006 Office Action, claims 24 and 28-30 were rejected under 35 U.S.C.

§103(a) as being unpatentable over Sehgal in view of DeYoung et al. (U.S. Patent No. 6,669,785) (hereinafter DeYoung). Applicants traverse such rejection.

Sehgal relates to a single-step method using supercritical fluids to remove resist and/or resist residue and to dry the substrates, which according to Sehgal provides a distinct advantage over prior art methods requiring follow-on cleaning and/or drying steps (see Sehgal, paragraph [0013]). For example, Sehgal recites:

- "It is highly desirable to expedite and thereby reduce the cost of the resist removal process by eliminating the need for follow-on cleaning and/or drying steps. It would be desirable to carry out the resist and/or resist residue removal and drying of the wafer in one step at low temperature." (see paragraph [0009]) (emphasis added)
- "Removing resist and/or resist residue, and drying of the wafer in one step at low temperature is possible using the compositions and methods disclosed herein for supercritical processing." (see paragraph [0010]) (emphasis added)
- "Using the disclosed compositions/methods of $scCO_2$ cleaning, one can remove very high implant levels photoresist (8×10^{15} atoms/cm^2) and come out with a dry, photoresist free wafer surface in a single step that is less harsh on the environment and the substrate itself than the multi-step processes currently used in the industry." (see paragraph [0071]) (emphasis added)

In contrast, the method disclosed in DeYoung is as follows:

> "A specific embodiment of the foregoing methods may be carried out by:
>
> (a) providing-a first (optionally but preferably nonaqueous) cleaning fluid, the first cleaning fluid comprising a single phase solution of an amine and a semi-polar to polar cosolvent in carbon dioxide;
>
> (b) providing a second cleaning fluid, the second cleaning fluid comprising an adduct of hydrogen fluoride with a Lewis base in carbon dioxide;
>
> (c) cleaning the substrate by contacting the substrate to the second cleaning fluid for a time sufficient to clean the substrate; and

> (d) cleaning the substrate before, after, or both before and after the cleaning step (c) by contacting the substrate to the first cleaning fluid for a time sufficient to facilitate the cleaning of the substrate." (see DeYoung, col. 2, line 55 through col. 3, line 4)

Comparing the teaching of Sehgal with that of DeYoung, it can be seen that Sehgal expressly relates to a single-step process and the elimination of follow-on cleaning steps, said single step being "less harsh on the environment and the substrate itself than the multi-step processes currently used in the industry." In contrast, DeYoung teaches at least a two-step cleaning process using two different cleaning solutions.

According to the Examiner, "the argument is not commensurate with the claims and additionally, De young [sic] reference is not applied to show the steps of the process but to show the use of both the triethylamine trihydrofluoride and hydrogen fluoride in the stripping of photoresist material" (see, October 24, 2006 Office Action, page 3, lines 4-7).

It is well established that if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. See, MPEP §2143.01 (V) (citing *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)). In other words, **applicants may argue non-combinability of the prior art references and never introduce any arguments relating to their pending claims**. Importantly, the Examiner did not comment on the non-combinability argument set forth by applicants in response to the May 11, 2006 Office Action, which is properly reiterated hereinbelow.

The intended purpose of Sehgal is a one-step process and the elimination of additional cleaning steps. Upon the combination of Sehgal with DeYoung, as proposed by the Examiner, a second cleaning step would have to be introduced because DeYoung teaches a two-step process. Clearly, the introduction of a second cleaning step defeats the intended purpose of Sehgal. Further, upon combination of Sehgal and De Young, should the required components of Sehgal, specifically the oxidizer and the carbonate species (which are not taught in DeYoung), be introduced to the first or the second DeYoung cleaning solution? Alternatively, should the two DeYoung removal compositions be combined into one composition for a single-step removal process consistent with Sehgal? None of these questions have clear answers, which compels the conclusion that there is no motivation, teaching or suggestion to combine Sehgal and DeYoung.

In conclusion, the combination renders Sehgal unsatisfactory for its intended purpose. Accordingly, applicants request withdrawal of the rejection of claims 24 and 28-30 under §103 as being unpatentable over Sehgal in view of DeYoung.

3. In the October 24, 2006 Office Action, claims 31-34 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sehgal in view of Xu et al. (U.S. Patent Application Publication No. 2003/0125225) (hereinafter Xu). Applicants traverse such rejection.

Again, as introduced hereinabove, **applicants may argue non-combinability of the prior art references and never introduce any arguments relating to their pending claims.** Importantly, the Examiner did not comment on the non-combinability argument set forth by applicants in response to the May 11, 2006 Office Action, which is properly reiterated hereinbelow.

According to the Examiner, Sehgal fails to teach the repetitive carrying out of the dynamic flow contacting and static soaking contacting of the substrate to be cleaned (see May 11, 2006 Office Action, page 5, lines 7-9). However, Xu teaches a "cleaning/removal process of unwanted residue including unexposed photoresist using supercritical fluid composition as claimed including the steps of contacting the fluid to the substrate by flowing and repeated cycles of soaking to achieve substantially complete removal of the unwanted materials from the substrate" (see May 11, 2006 Office Action, page 5, lines 10-14) (citing Xu, paragraphs [0059]-[0061]).

Specifically, the portion of Xu that the Examiner cited states, *inter alia*:

> "If necessary, repeated cycles of soaking and **decompression** may be utilized to achieve substantially complete removal of the unwanted material from the semiconductor wafer." (emphasis added)

In other words, Xu expressly teaches, and the Examiner specifically cited, a cycling process including a pressure change.

Considering Sehgal as a whole, as the Examiner must do, it can be seen that Sehgal expressly recites in paragraph [0135] that the cleaning process is carried out without pressure cycling:

> "It is significant to note that, as with the cleaning in all of the examples of this application, the cleaning in this example was carried out at a single operating pressure **without** any pressure cycling. Several known processes use pressure cycling to remove photoresist and etch residue from wafer surfaces under $scCO_2$ conditions. In these processes, pressure cycling is needed because the processes use solutions that undercut the photoresist and lift it off the substrate. The undercut photoresist needs to be moved off the wafer surface and dissolved into the co-solvent mixture and/or captured in a filter. These known processes achieve this by recirculating the $scCO_2$ and co-solvent mixture at a high rate in a process loop, and partially and fully exhausting the high pressure chamber. In contrast, the embodiments described herein utilize co-solvent mixtures that dissolve the photoresist and etch residue into the co-solvent 1 mixture, thus **avoiding the need for wasteful pressure cycling**." (emphasis added)

In other words, Sehgal expressly teaches away from the combination of Sehgal and Xu, as proposed by the Examiner – the process of Sehgal is expressly intended to be carried out without pressure cycling.[1] It is well established that it is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983).

Furthermore, Sehgal teaches away from applicants' pressure cycling claims. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984) (emphasis added).

In conclusion, because Sehgal teaches away from Xu and applicants' claimed invention, the Examiner has failed to establish a *prima facie* case of obviousness of claims 31-34 in view of Sehgal and Xu. Accordingly, applicants respectfully request withdrawal of the rejection under §103.

Conclusion

Claims 15-37 are now in form and condition for allowance. Favorable action is hereby requested. Authorization is hereby given to charge any deficiency in applicable fees for this response to

[1] This is further evidenced by the disclosure in Sehgal at paragraphs [0024] and [0042].

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Deposit Account No. 13-4365 of Moore & Van Allen PLLC. If any additional issues remain, the Examiner is requested to contact the undersigned attorney at (919) 286-8090 to discuss same.

Respectfully submitted,
MOORE & VAN ALLEN PLLC

Date: Jan. 9, 2007

By: _____

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